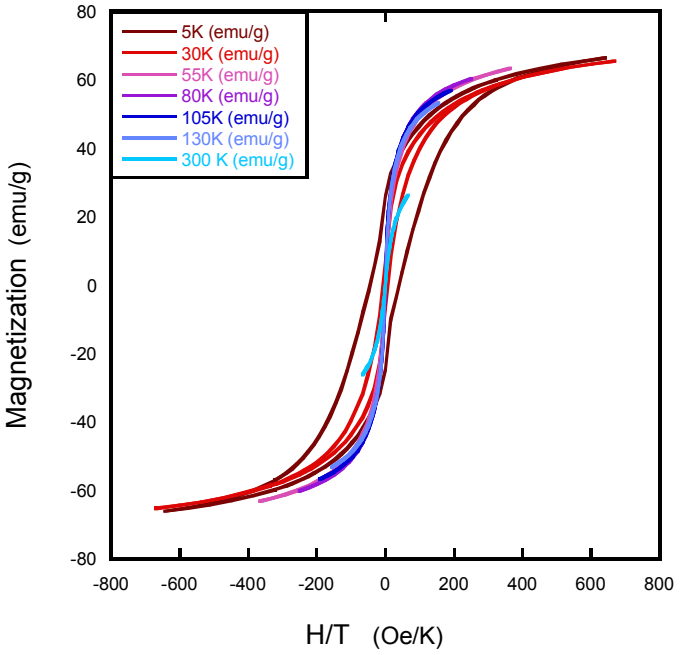
Nanocrystalline Oxides For Integrated, Soft Magnetic Applications

David Clarke, UC Santa Barbara, DMR-0203785

Increasing demands for more compact, higher performance electronic devices require smaller, higher power and higher efficiency dc-dc power converters. In turn, these can only be met with improved soft magnetic materials having higher permeability and lower magnetic losses. The challenge we are addressing is how to create new magnetic materials using nanocrystalline particles which can be fabricated into an integrated power-converter whilst preserving the novel combination of magnetic properties of nanoparticles.

The research is a collaborative GOALI program with Rockwell Scientific, a manufacturer of power converters.



Magnetization loops of packed, monosize 2.7 nm diameter nanoparticles of cobalt ferrite at different temperatures illustrating that they do not have magnetic hysteresis losses above 100K. The particles were prepared by a glycol precipitation route, a method suited to large volume production of nanoparticles.

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Education:

The grant is supporting two graduate students, Brian Naughton and Jennifer Andrew, in the Materials Department and in the California NanoSystems Institute, a joint UC Santa Barbara and UC Los Angeles collaborative research center. As an integral part of the GOALI program, Brian Naughton spent part of the first year collaborating with scientists at Rockwell Scientific learning about magnetic requirements for power converters and measurement methods.

Outreach:

During this first year of the program, Brian Naughton mentored a high-school student, Pawel Majewski, from Poland in this country under the auspices of the NSF RISE program. Pawel developed an inverse micelle route for making uniform, nanoparticles of Gd_2O_3 and is now an undergraduate studying chemistry and biochemistry at Warsaw University.